**Combustion**

**QUESTION: Write balanced equations for the complete and incomplete complete combustion of the following molecules**

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| --- | --- | --- |
| organic molecule | equation for complete combustion | equation for incomplete combustion |
| **methane** |  |  |
| **octane** |  |  |
| **methanol** |  |  |
| **butane** |  |  |
| **pentane** |  |  |
| **ethanol** |  |  |
| **propane** |  |  |

### Additional questions on combustion

**1.** Alkanes can be used as fuels. Compare and contrast: the complete combustion of alkanes, which produces carbon dioxide; and the incomplete combustion,

which produces carbon monoxide and carbon in addition to carbon dioxide. In your answer, you should:

• use butane as an example to illustrate your answer

• give an explanation of an effect on the environment for TWO combustion products

• include balanced symbol equations for the reactions occurring, in the labelled boxes below.

**2.** Camping burners usually have a warning notice instructing people to always use them in a well-ventilated place (plenty of oxygen) otherwise serious injury

or death may occur. Elaborate on why this warning is given on camping burners.

Use a burner that contains **propane** as an example. In your answer, you should:

• state the type of combustion reaction that occurs when there is a shortage of oxygen

• describe the observations that may be seen if there was a shortage of oxygen, and link these to the reaction occurring

• explain two effects that the combustion products can have on human health when there is a shortage of oxygen

• write a word equation and a balanced symbol equation for the reaction occurring.

**3.** Methanol and methane are commonly used in fuels. Methanol burns with an almost colourless flame. Methane, if there is a limited supply of oxygen, burns

with an orange flame. Explain the process and effects of complete and incomplete combustion reactions, using methanol and methane as examples. In your

answer:

• describe both types of combustion reactions

• elaborate on ONE effect each of complete AND incomplete combustion can have on EITHER human health OR the environment

• relate your explanation to the combustion of methanol and methane

• write ONE appropriate balanced symbol equation.

**4.** Compare and contrast the **complete** combustion of methanol to the **incomplete** combustion of octane. In your answer:

• compare and contrast the combustion reactions of both fuels

• compare and contrast the impacts of the combustion products of **both** fuels on human health **or** the environment

• write a balanced symbol equation for the complete combustion of methanol.

**5.** Ethanol burns in air with an almost invisible flame. State the type of combustion reaction ethanol undergoes and name the products formed.

Identify and evaluate ONE effect that a product of the complete combustion reaction for ethanol would have on the **environment**.

**6.**  Ethene burns with a smoky flame in a limited oxygen supply. Identify and explain TWO negative effects on **human health** of the products of this

combustion reaction.

**7.**  Both butane and methanol can be used as fuels. A sample of butane burns in air with a yellow flame, while a sample of methanol burns in air with an almost

invisible flame. Compare and contrast the combustion of these two fuels.

**8.** Combustion of fuels can have negative effects on both human health and the environment. Identify and explain TWO negative effects of the combustion of fuels on both human health and the environment. Your answer should include:

• ONE negative effect on human health, and

• ONE negative effect on the environment.

**9.** Propane and methanol are carbon compounds that are used as fuels. When propane is burning with an orange flame it produces soot. When methanol is burning with an almost invisible flame it produces no soot.

Discuss the effect on the environment of burning propane and methanol as described above. In your answer, you should:

explain how the combustion of propane and the combustion of methanol differ

identify which combustion reaction has the greater negative effect on the environment and justify your answer.

**10.** Discuss TWO impacts (positive or negative) that the products of the complete combustion of methanol would have on the environment.

**11.**  Pentane and ethanol are two colourless organic liquids that can be used as fuels. Discuss the similarities and

differences for the combustion of both fuels. Include in your answer:

• the observations made when each fuel is burned

• the impact of combustion on the environment for each fuel.

**12.** Propane and ethanol are organic compounds used as fuel. Propane burns with an orange flame and some soot forms. Ethanol burns with an almost invisible flame with no soot forming. By considering the products of these reactions, predict and justify which fuel will have the larger impact on people.

Include examples of how people would be affected, and an appropriate balanced equation for each fuel.

**13.** State TWO reasons why organic compounds such as butane are used as fuels. Explain the difference between complete and incomplete combustion of fuels.

**14.** If insufficient oxygen is available in a car engine, incomplete combustion can occur. Describe incomplete combustion and discuss its impact on human health.

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| **15.** | **Ethanol** | **Propane** |
| Source other than crude oil and method of production. | Fermentation of plant sugars in sugar beet. | Removing other compounds from natural gas. |
| Energy given out by burning 100 g of fuel. | 2958 kJ | 5027 kJ |
| State at 25oC | liquid | gas |
| Storage in motor vehicles. | As a liquid in ‘petrol’ tank. | As a liquid in heavy, pressurised cylinder. |
| Mass of carbon dioxide produced from 100 g of fuel. | 191 g | 299 g |
| Observation during burning in air. | Burns with an almost invisible ﬂame.  No soot remains. | Burns with a yellow ﬂame.  Some soot forms. |

Compare ethanol and propane in terms of:

• the impact of the combustion of each fuel on people and the global environment

• the energy produced by the burning of each fuel

• safety considerations in handling and storing the fuels.

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